Quantifying the accuracy of the MODIS fire product and distinguish between conversion and maintenance land cover dynamics

LBA Ecology
Land Cover – 23

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Background

- Brazilian government (through IBAMA) is charged with monitoring Brazilian fires
- Several satellites and methods are available for monitoring “Hot Spots”
- MODIS provides “state of the art” fire detection, but needs to be validated
- It would be helpful to differentiate between fires that cause land-cover change from those that maintain a state of equilibrium (relevant for deforestation, emissions, and management/monitoring/enforcement)

Objectives

- Assess the accuracy of the 1 km MODIS fire product over the LBA-Study area – contributing to stage 2 validation of the MODIS active fire product
- Distinguish between "conversion" fires (the result of recent clear-felling of forest in preparation for agriculture or pasture) and "maintenance" fires (used to maintain or restore degraded pasture and agricultural areas)
- Feed results and estimates of uncertainty into land cover / land use change and carbon modeling

Grassland fire

Edge-effect = positive feedback

Status

- Currently in second of three years
  - UMd "subcontract" is still in year one or three
  - Brazilian colleague has applied to UMd/Geography PhD program
- 3 of 4 field campaign are complete
  - one more this summer, "inter-project burn"
- Roughly _ of the research complete
  - ASTER fire detection algorithm in place
  - MODIS VI products have been ingested and QA-filtered
  - 3 abstracts will be submitted to July LBA meeting and Morisette and Schroeder will chair a workshop and session on accuracy assessment of fire products

Methods

- Conduct prescribed burns coincident with ground measurements, aircraft imagery, and multiple resolution satellite data
- Compare land cover dynamics through multiple sources

General Scaling procedure for global land product validation

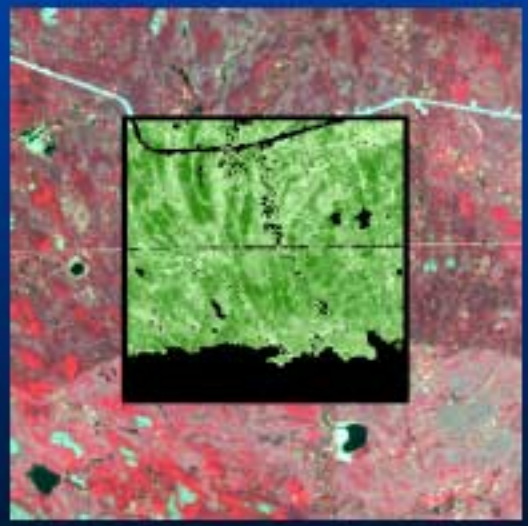
?

Point on the ground

Create high res. products by coupling high res. imagery with field and tower data

1km (Coarse)

Aggregate



Some graphics courtesy of BigFoot project

Morisette, J. T., J.L. Privette, and C.O. Justice, A framework for the validation of MODIS land products"
Remote Sensing of Environment, 83 (1-2) 77-96, 2002.

Methods

- MODIS validation through prescribed burns coincident with field measurements, aircraft imagery, and multiple resolution satellite data
  - Detailed field-GPS locations with ground observations
  - *In situ* temperature
  - Wind speed and direction
  - Use field measurement to develop Terra: ASTER fire map
  - Use logistic regression to estimate the probability of MODIS fire detection as a function of ASTER fire maps*

* Morisette, J.T., L.Giglio, I.Csiszar, C.O. Justice, "Validation of the MODIS Active fire product over Southern Africa with ASTER data", International Journal of Remote Sensing. (S2k special issue, Privette and Roy eds)

Methods

- Compare land cover dynamics through multiple sources:
  - Spectral analysis of MODIS Vegetation Index time series (MOD13, 250m resolution) before and after fire
  - MODIS vegetation continuous fields (MOD44, 500m resolution (in conjunction with Defries et al.)
  - Associate MODIS Hot spots with land cover class from INPE's (National Institute for Space Research) map of deforestation

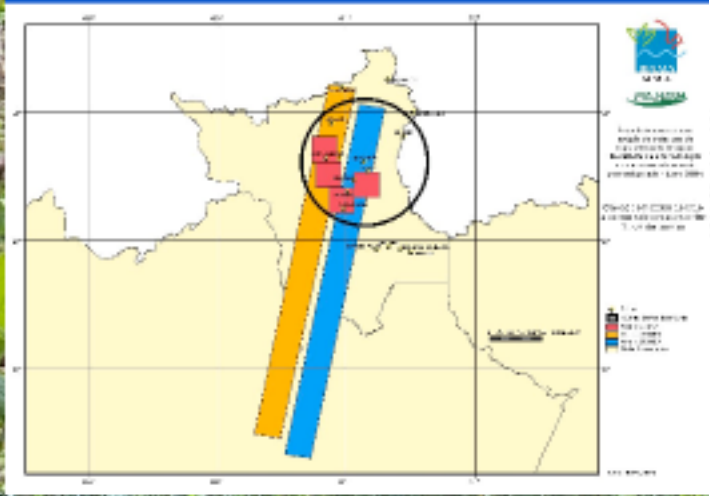
Site Selection

- Roraima
  - Site of major burning/deforestation in the past (January 1998)
  - Logistically provides an opportunity for Jan/Feb campaign
  - Field campaigns in January '03, February '04
- Santarem/Tapajos
  - Representative of small-holder land clearing
  - Part of EOS Land Validation Core sites, so data can serve other LBA/MODIS validation activities in the area

Field campaigns

- Local land owners are contacted and areas are assigned a date to burn (coinciding with MODIS/ASTER)
- Area inventory is created (area perimeter through GPS measurements, pictures, land history)
- Thermocouples are installed in the area for fire temperature measurements
- Fire is set matching satellite overpass, fire front length measured when feasible (GPS)
- When available, airborne sensors are flown during the whole time (pre-to-post fire period)

Land owners are visited and areas are assigned a pre-defined date to burn

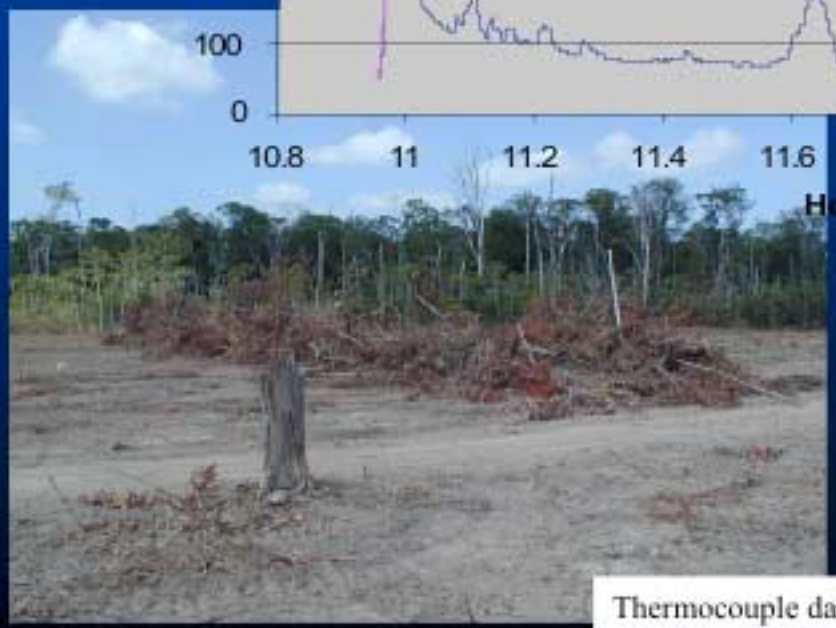


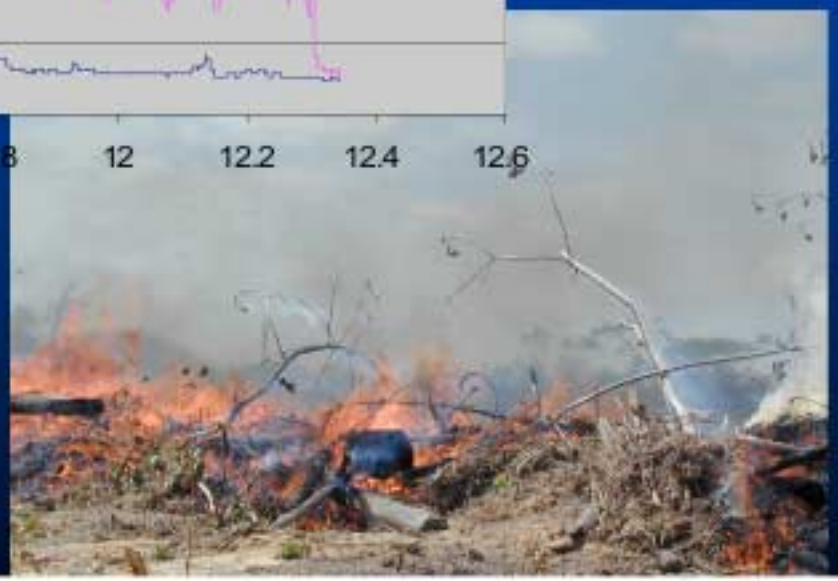
Thermocouple installed at different heights

Hard Working Brazilian

Easy-going US collaborator

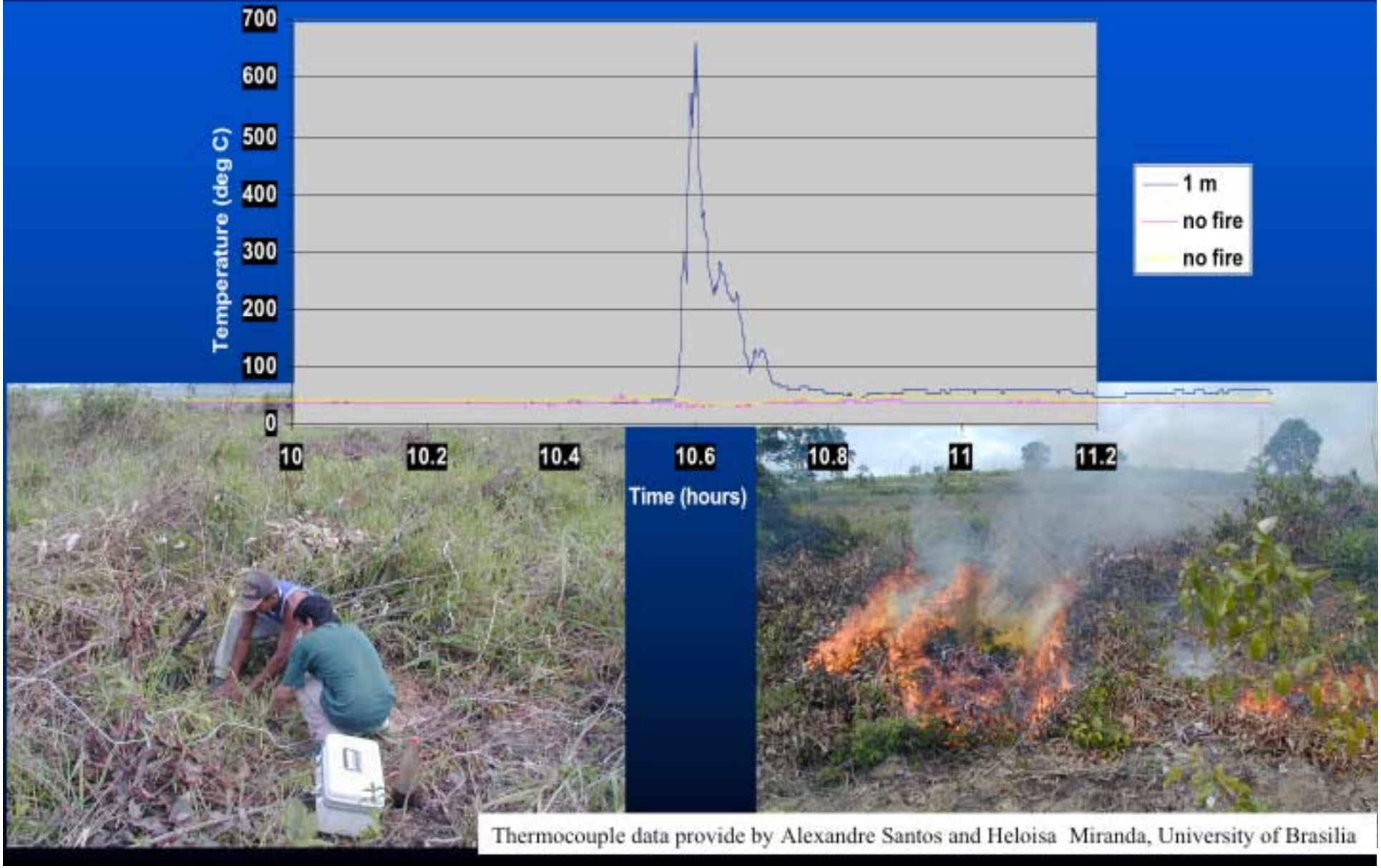
Thermocouple data: agricultural preparation





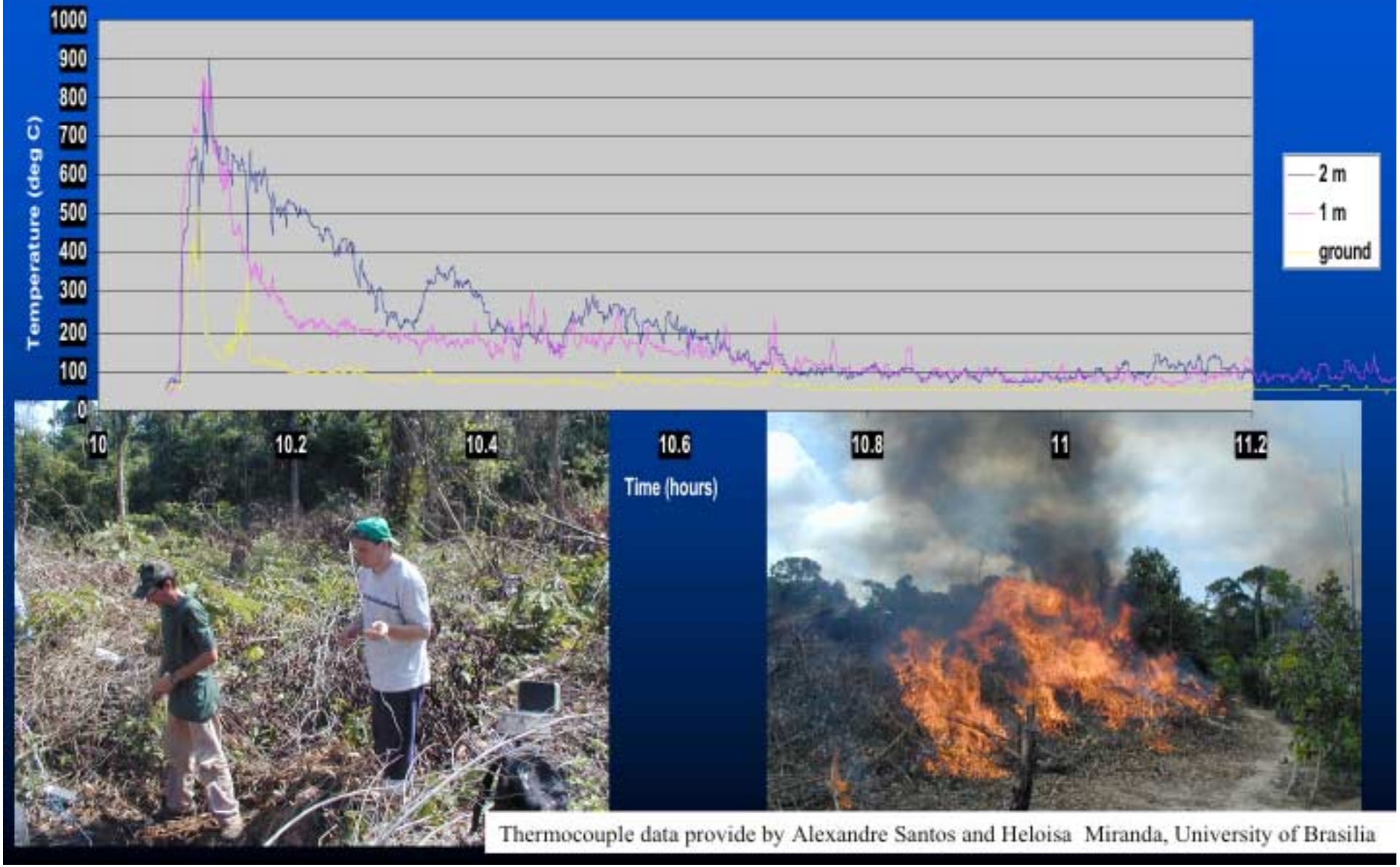
Thermocouple data provide by Alexandre Santos and Heloisa Miranda, University of Brasilia

Thermocouple data: woody/shrub



Thermocouple data provide by Alexandre Santos and Heloisa Miranda, University of Brasilia

Thermocouple data: cleared forest

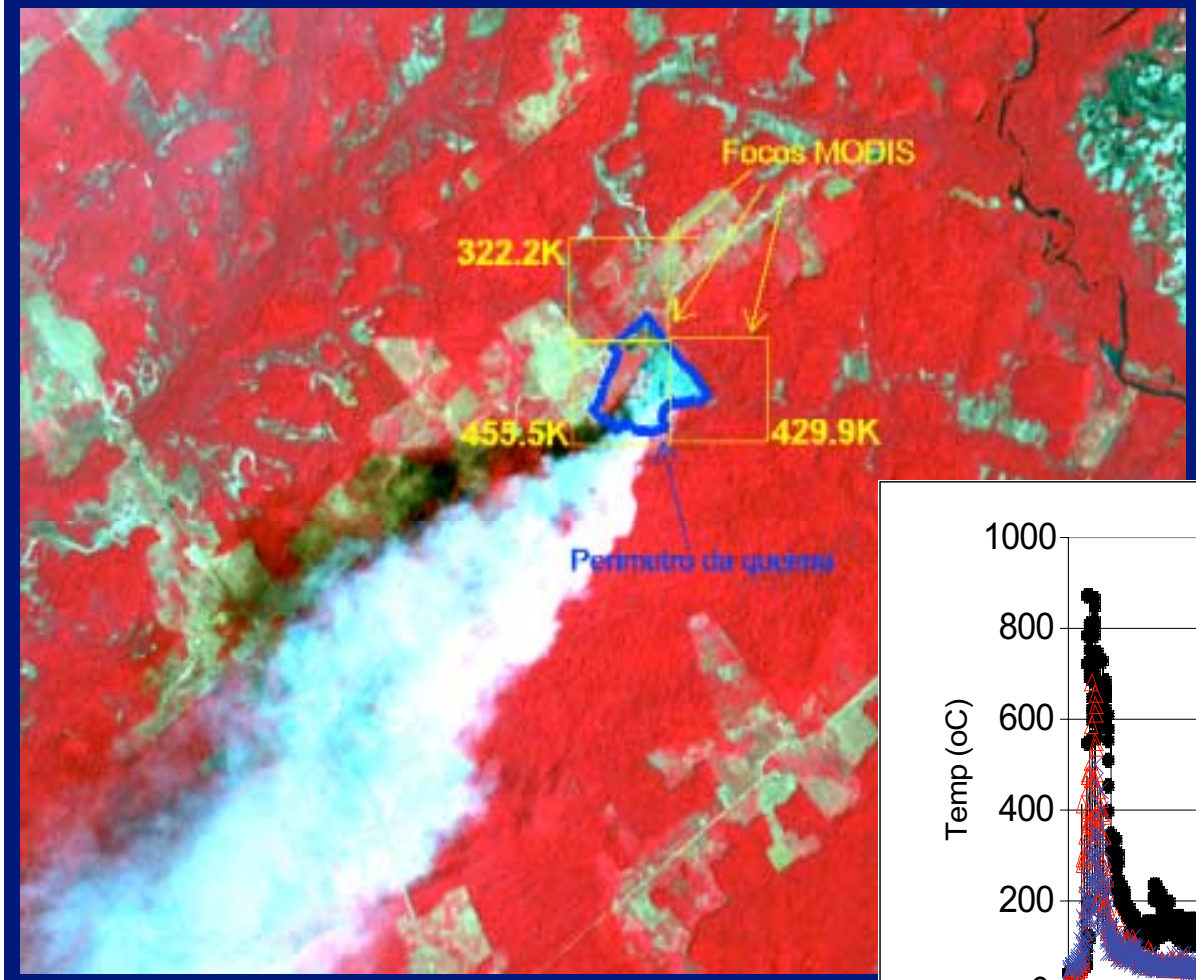


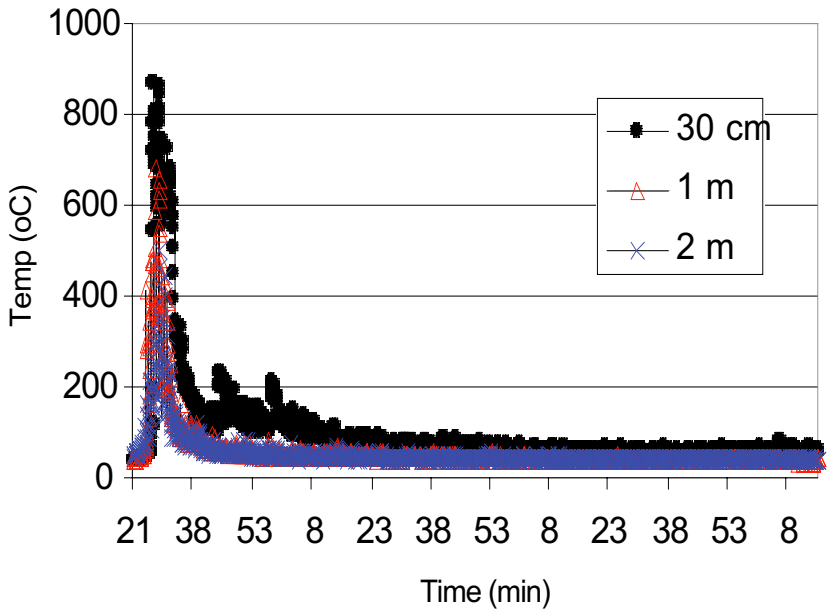
Thermocouple data provide by Alexandre Santos and Heloisa Miranda, University of Brasilia

Thermocouple data: grassland

Thermocouple data provide by Alexandre Santos and Heloisa Miranda, University of Brasilia

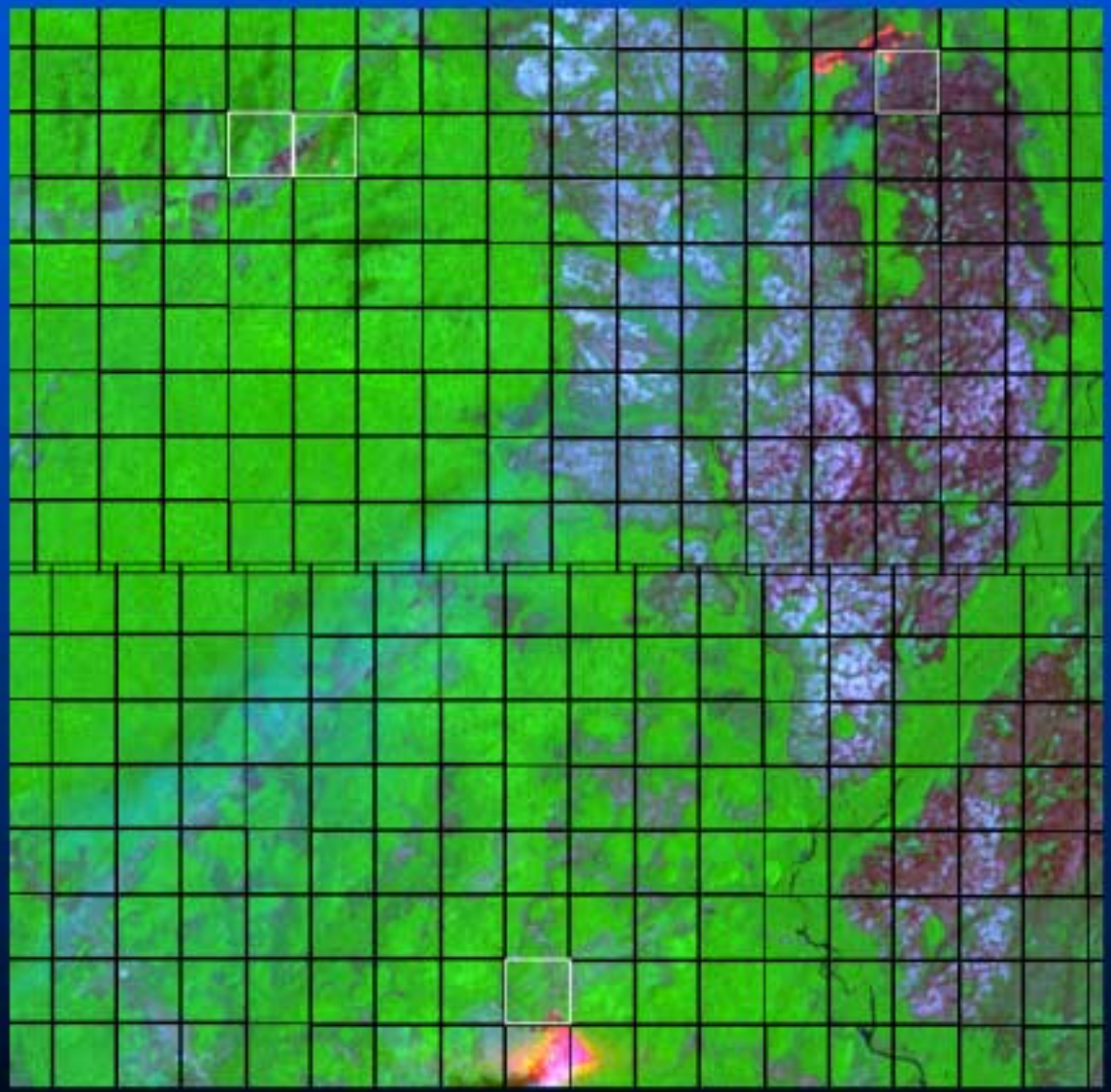
Roraima: 28 January 2003





Roraima: 28 January 2003

MODIS Gridded fire product over ASTER imagery



Red= ASTER band 8 (2.33μm)
Green = ASTER band 3 (.81μm)
Blue = ASTER band 1, (.55μm)